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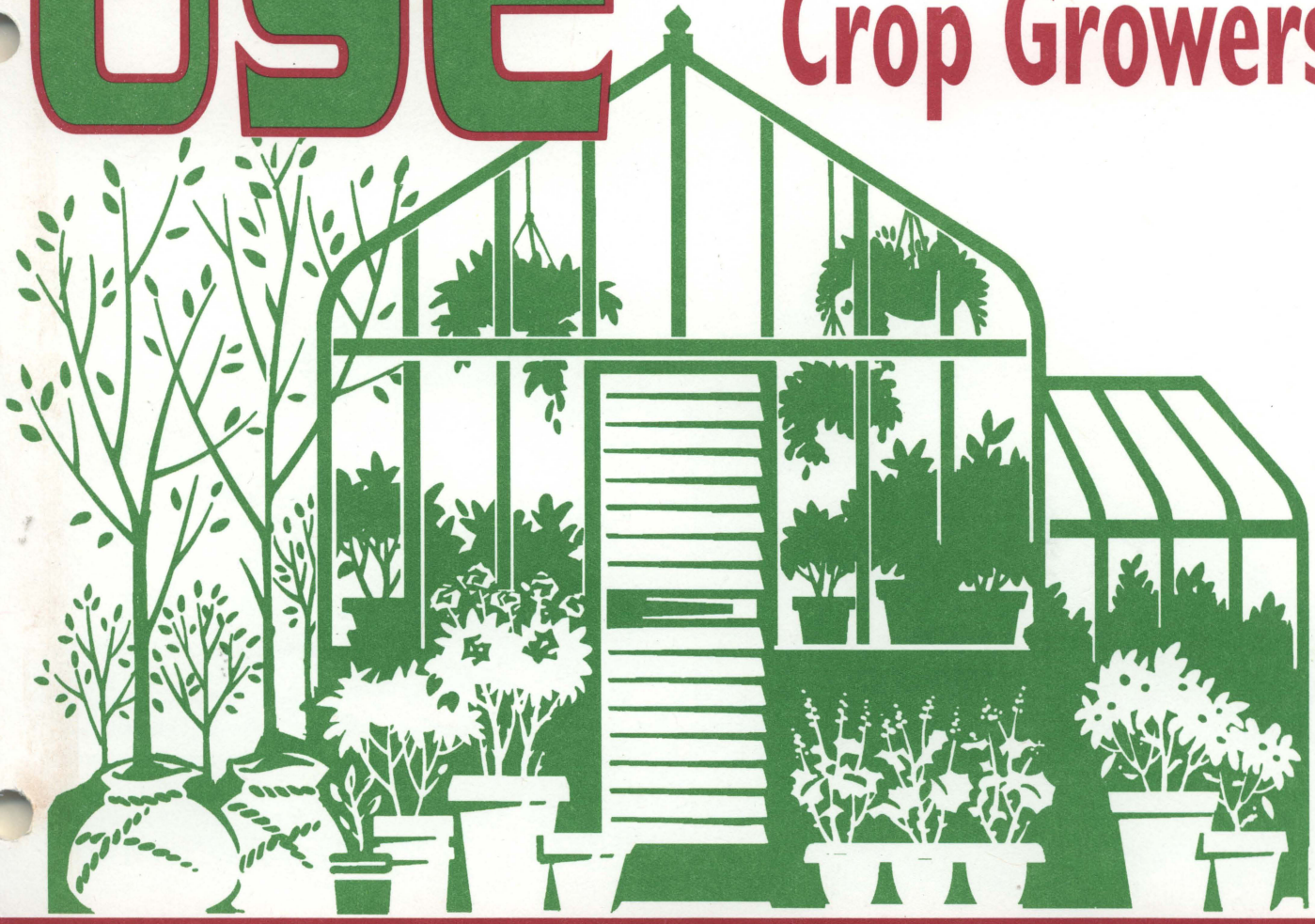
pesticide use by Texas Nursery Crop Growers



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Pesticide Use by Texas Nursery Crop Growers

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Introduction

Texas nursery crop growers produce a wide variety of ornamental plants, shrubs, vines and trees for both indoor and outdoor use. The total acreage on which nursery crops are grown is far less than that of crops such as cotton, corn, sorghum or wheat, but nursery crops account for a significant share of the state's agricultural income. In 1991, Texas nursery crop growers had gross sales of $140.6 million (Baisdon, et al.).

A survey was conducted to document pesticide use by nursery crop producers. This information can identify needs that should be addressed by research and Extension efforts (particularly the development of alternative pest control strategies), and support the continued registration and availability of chemicals critical to the success of this agricultural enterprise.

Methods

Extension specialists in entomology, horticulture and agricultural economics helped develop a pesticide use questionnaire and made recommendations for conducting the survey. With their guidance, nursery growers were divided into five crop categories: bedding plants (plants–not woody–grown for landscapes); flowering plants (sold as pot plants and as cut flowers); foliage plants (non-flowering, indoor potted plants); container-grown plants (woody plants–shrubs and trees and some ground covers and vines–produced in containers outdoors and sold for planting in landscapes); and field-grown plants (mostly trees grown in the ground and dug up to be replanted in landscapes).

Growers' names and phone numbers were obtained from county Extension agents, Extension specialists and the Texas Association of Nurserymen. Growers in each nursery crop category were contacted by telephone and asked to participate in the survey. Those who agreed were sent questionnaires to review before the scheduled interview.

Growers' responses to the questionnaires were entered into a computer spreadsheet and summarized in tables. Results of this survey were compared to those of a national survey (Higginbotham).

Results

Thirty-seven growers participated in the survey. Face-to-face interviews were conducted with 35 of the growers, and two completed questionnaires on their own and returned them. In all, 42 questionnaires were completed (Table 1). Four growers who produce more than one nursery crop category completed separate questionnaires for each crop type. Two growers who produce more than one nursery crop did not separate their responses by category; their responses are referred to as "mixed." Questionnaires completed included: ten bedding plant growers, ten container-grown, nine field-grown, five flowering plant, six foliage plant and two mixed operations.

Annual gross sales of 29 of the growers who responded to the survey totaled more than $72 million (Table 1). Since the annual gross sales of all Texas nursery crop growers is about $140 million, we estimate that the 37 growers who participated in this survey produce well over half of all nursery crops produced in Texas.

National Survey Compared to Texas Survey

The results suggest that: (1) the average nursery size in Texas is smaller than the national average; (2) Texas nurserymen rely on more different pesticides than nurserymen nationwide; and (3) average gross sales from Texas nurseries are higher than the national average.

A national pesticide use survey found that 69 percent of respondents had production sites of 10 acres or more, compared to 51 percent of the Texas survey respondents. In the national survey, 74 percent of respondents used six or more different pesticides in their production operations, compared to 86 percent of the Texas survey respondents. Annual gross sales were less than $100,000 for 44 percent of the national survey respondents, but for only 14 percent of the Texas survey respondents. Of the national respondents, 9 percent had annual gross sales of $3 million or more, compared to 21 percent of the Texas respondents (Higginbotham).

In the national survey, Sevin® was the insecticide used by the most growers, followed by Orthene® (Table 2). It was Orthene® followed by Talstar® in the Texas survey (Table 3). Roundup® and Surflan® were the first and second most popular herbicides among respondents in both the national and Texas surveys (Tables 4 and 5). The fungicide most used was Benlate® in the national survey and Subdue® in the Texas survey (Tables 4 and 6).

Texas Survey

Growers were asked to estimate their total "land" area and their total "production" area. Land area refers to actual surface area and production area refers to multiple usage area. An area is "multiple use" if it is used for more than one crop per year, or contains ground as well as hanging plants, etc. (Example: An acre that produces two crops per year would be 2 production acres).

In the survey, land area responses ranged from 0.13 to 700 acres with an average of 75 acres (Table 1). Overall, production area averaged 81 acres. There was a total of 3,146 land acres and 3,419 production acres. Both land and production areas were quite large for the mixed, container and field crop categories as compared to the bedding, flowering and foliage categories. There was little difference between land area and production area in the mixed, container and field categories, but in the bedding, flowering and foliage categories production area was substantially higher than land area, indicating high multiple use of land area in these categories.

In all but the bedding and field categories, at least one pesticide was applied to all production acres (Table

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1). A total of 5 production acres in the bedding category and 440 in the field category received no pesticide treatment. Overall, 87 percent of all production acres were treated with at least one pesticide.

Annual gross sales for all growers surveyed ranged from $25,000 to $20 million (Table 1). The average was just over $2.4 million. Average gross sales were highest in the container, bedding and mixed categories–$4.1, $4 and $1.5 million, respectively. Foliage, flowering and field category average gross sales were $1.18 million, $625,000 and $268,000, respectively.

Back-pack sprayer was the most common method of pesticide application by growers in all nursery categories except flowering plants, where fogger was the most common. The second most common method was hand gun. The three most popular non-chemical pest control methods used were mowing, hand pruning and culling. The main reasons growers gave for using the non-chemical pest control methods were "concern about effects on non-target species" and "less expensive than agricultural chemicals."

Most growers conducted "monitoring/scouting" and "visual inspection for disease symptoms" activities to measure the presence and concentration of pests. More than half of the growers conducted daily "monitoring/scouting" activities for insects and diseases, while a third did so for weeds. "Scout and treat" was the most common method used to make pesticide treatment decisions for insects, weeds and diseases, followed by "preventative treatments" and "pest life cycle" for insects and "preventative treatments" for weeds and diseases. The third most common method for weeds and diseases was "regular schedule."

Growers were asked to check which sources of information they used for making their decisions on chemical and non-chemical methods of pest control. Seventy-nine percent checked "other growers," 76 percent said "suppliers/dealers," 76 percent said Extension educators/specialists, 69 percent checked trade journals, and 57 percent said nursery association.

The 37 survey respondents reported using a total of 68 different insecticides, 37 different fungicides and bactericides, 24 different herbicides and 13 different growth regulators. Of the 35 growers who reported the pesticides they used, 80 percent reported using Orthene®. Fifty-seven percent used Talstar®; 46 percent used Avid®; 89 percent used Roundup®[1]; 23 used Surflan®; 51 used Subdue®; and 49 used Domain®[2].

The growth regulators B-Nine®, Bonzi®, and Cycocel® were used by 43 percent, 34 percent and 34 percent of the growers, respectively. Container growers used the greatest number of agricultural chemicals (117 different chemicals) and field growers used the least (22). Growers in all five crop categories used more insecticides than any other type of agricultural chemical. Nationally, herbicides account for an estimated 60 percent of the chemicals used in all of agriculture, and insecticides account for 20 percent (Table 7). In this survey of Texas nurserymen, herbicides made up only 15 percent of the total chemical use, while insecticides accounted for 35 percent.

Twenty-eight growers supplied information on the number of production acres treated with each pesticide. Roundup® was applied to the most production acres (411), followed by Orthene® (271 acres) and Domain®[2] (254 acres). Twenty-nine growers used 598 gallons of Roundup® and 1,644 pounds of Orthene® Turf, Tree and Ornamental Spray.

Thirty-four growers reported on specific pests they treat. Insects most treated were aphids, whiteflies and fire ants (65 percent, 62 percent and 47 percent, respectively) (Table 8). The diseases most treated were pythium (47 percent) and phytophthora root rot (32 percent) (Table 9). The weeds listed most often as target pests were grasses (18 percent) and broadleaf weeds (15 percent) (Table 10). By category, the main pests were: bedding plants–whiteflies, aphids, insects in general and weeds; flowering plants–thrips and whiteflies; foliage plants–pythium root rot, mealybugs, phytophthora root rot, rhizoctonia root rot, spider mites and weeds; container-grown–aphids, fire ants and whiteflies; and field-grown–weeds and fire ants. Eight container growers treated for a total of 70 different pests, while nine field growers treated for a total of 17 different pests. Eight of nine bedding plant growers used growth regulators.

Growers used an average of 4.9 different insecticides to control whiteflies (Table 11). One grower used 18 different insecticides. Among all growers surveyed, a total of 22 different insecticides were used to control whiteflies. Growers used an average of 3.1 different insecticides to control aphids. Twenty were used in all. The average insecticide cost of controlling whiteflies was $231 per production acre (excluding application costs) (Table 12). The average cost was $226 for mealybugs, $54 for aphids and $16 for fire ants.

The combined annual gross sales of 22 growers was $64 million, and their combined agricultural chemicals costs were $1.175 million (Table 13). Chemical costs were 1.84 percent of annual gross sales. By nursery crop category, container grown had the highest average chemical costs as a percent of gross sales (2.49 percent) and flowering the lowest (1.03 percent). For all crop categories, combined chemical costs per land acre were $1,531. They averaged $2,607 per land acre for flowering plants, $1,661 for foliage plants, $1,637 for container-grown plants, $1,108 for bedding plants and $41 for field-grown plants.

[1]Roundup total includes one answer marked "Ruler."

[2]Domain includes answers marked "Cleary's 3336," "Fungo-flo," "Topsin-M" and "Thiophanate Methyl."

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Table 1. General Information from the Texas Survey.

Item	Overall	Bedding	Container	Field	Flowering	Foliage	Mixed[1]
Number of Questionnaires Completed	42	10	10	9	5	6	2
Land Area - average (acres)	75	8	139	142	3	14	152
Land Area - range (acres)	0.13 - 700	0.13 - 44	3 - 700	6 - 500	0.5 - 5.7	0.5 - 35	4.5 - 300
Production Area[2] - average (acres)	81	22	140	142	9	29	155
Production Area - range (acres)	0.26 - 700	0.26 - 131	3 - 700	6 - 500	0.5 - 17.4	2.5 - 70	10.3 - 300
Total Production Area NOT Treated[3] (acres)	445	5	0	440	0	0	0
Annual Gross Sales - average (dollars)	2,406,333	4,025,714	4,132,500	267,857	625,000	1,181,250	1,550,000
Annual Gross Sales - range (dollars)	25K - 20M	40K - 20M	125K - 13M	25K - 1M	50K - 1.2M	50K - 3.7M	1.5K - 1.6M
Annual Gross Sales - total (dollars) (29 growers)	72,190,000						

[1]One grower had bedding, flowering, and foliage plants and one had foliage and container grown plants. Their responses were not separated by crop type.

[2]Production area refers to total land used including multiple use. It includes yearly multiple crops, hanging plants, etc. For example: one acre which produces two crops in a year would be two "production" acres.

[3]Area not treated with any agricultural chemical.

Table 2. National Survey - Most Used Insecticides, Miticides and Nematicides.

Trade Name	No. of Growers	Percent[1]
Insecticide		
Sevin	52	10
Orthene	46	9
Malathion	40	8
Diazinon	29	6
Horticultural oils	28	6
Chlorpyrifos[2]	26	5
Lindane[3]	22	4
Safer's Insecticidal Soap	21	4
Talstar	19	4
Miticide		
Horticultural oils	31	14
Kelthane	29	13
None	22	10
Avid	21	10
Talstar	21	10
Cygon	18	8
Mavrik	15	7
Pentac	9	4
Vendex	9	4
Nematicides		
None	43	68
Diazinon	10	6
Mocap	3	5

Source: Higginbotham.

[1]Respondents were given a list of products used and asked to mark the three they use most: write-in answers were also tabulated. Thus 10% of the total number of answers marked in the "insecticides" category were "Sevin." Only responses with totals of 4% or more in each category are listed.

[2]Includes answers marked "Chlorpyrifos," "Dursban" and "Lorsban."

[3]Includes answers marked "Lindane" and "Isotox."

Table 3. Texas Survey - Insecticides Used.

Trade Name of Insecticide	Growers Number	Growers Percent[1]	Trade Name of Insecticide	Growers Number	Growers Percent
Orthene	28	80.0	Metaldehyde	3	8.6
Talstar	20	57.1	Di-Syston	2	5.7
Avid	16	45.7	Dycarb	2	5.7
Enstar[2]	15	42.9	Exhibit	2	5.7
Diazinon[3]	14	40.0	Lindane	2	5.7
Dursban	14	40.0	Metasystox-R	2	5.7
Oxamyl[4]	13	37.1	Nicotine	2	5.7
Mavrik	12	34.3	Omite	2	5.7
Safer[5]	12	34.3	PT 1100	2	5.7
Award[6]	11	31.4	Bio Worm Killer	1	2.9
Malathion	11	31.4	Carzol	1	2.9
Pentac	11	31.4	Citation	1	2.9
Tame	10	28.6	Cygon	1	2.9
Amdro	8	22.9	Dibrom	1	2.9
Lannate	8	22.9	Dipel	1	2.9
Dithio[7]	7	20.0	Metasystox-R	1	2.9
Kelthane	7	20.0	Methiocarb	1	2.9
Sevin[8]	7	20.0	Prentox	1	2.9
Decathlon[9]	6	17.1	PT Methiocarb	1	2.9
Grandslam[10]	6	17.1	PT Sumithrin	1	2.9
Margosan-O	6	17.1	Pyrenone	1	2.9
SunSpray[11]	6	17.1	Pyronil	1	2.9
Thiodan	6	17.1	Temik	1	2.9
Vendex	5	14.3	Turcam	1	2.9
Gnatrol	4	11.4	Vapona	1	2.9
PT 1200 Resmethrin[12]	4	11.4	Wasp Freeze	1	2.9

[1]Percent of 35 growers total.
[2]Includes answers marked "Enstar" and "Enstar II."
[3]Includes answers marked "Diazinon" and "Knox-Out."
[4]Includes answers marked "Oxamyl" and "Vydate."
[5]Includes answers marked "Safer" and "M-Pede."
[6]Includes answers marked "Award," "Logic," and "PT 2100 Preclude."
[7]Includes answers marked "Dithio" and "Plantfume."
[8]Includes answers marked "Sevin" and " Green Light."
[9]Includes answers marked "Decathlon" and "Tempo 2."
[10]Includes answers marked "Grandslam," "PT 1700," "Methiocarb," "Green Light," "Slug-Geta," and "Mesurol."
[11]Includes answers marked "SunSpray" and "Dormant oil."
[12]Includes answers marked "PT 1200 Resmethrin" and "Resmethrin."

Table 4. National Survey - Most Used Fumigants, Fungicides and Herbicides.

Trade Name	No. of Growers	Percent[1]
Fumigant		
None	45	58
Methyl bromide	24	31
Vapam	6	8
Basamid	3	4
Fungicides		
Benlate[2]	51	15
Subdue	44	13
Captan	33	10
Chipco Aliette	18	5
Banrot	14	4
Herbicides		
Roundup[3]	94	20
Surflan	46	10
Princep[4]	35	7
Ronstar	27	6
Poast	25	5
Goal	22	5
Casoron	20	4
2,4-D[5]	20	4
Devrinol	17	4

Source: Higginbotham.

[1]Respondents were given a list of products used and asked to mark the three they use most; write-in answers were also tabulated. Thus 58% of the total number of answers marked in the "fumigants" category were "none." Only responses with totals of 4% or more in each category are listed.

[2]Includes answers marked "Benlate," "Benomyl," and "Tersan."

[3]Includes answers marked "Roundup" and "Glysophate."

[4]Includes answers marked "Princep" and "Simazine."

[5]Includes answers marked "2,4-D" and "Weed-B-Gon."

Table 5. Texas Survey - Herbicides Used.

Trade Name	No. of Growers	Percent[1]
Herbicide		
Roundup[2]	31	89
Surflan	8	23
Gramoxone[3]	6	17
Ronstar	5	14
Snapshot	4	11
OH2	3	9
Treflan	3	9
Diquat	2	6
Gallery	2	6
Karmex	2	6
Pennant	2	6
Poast	2	6
Princep	2	6
SWGC	2	6
Acclaim	1	3
Arsenal	1	3
Basagran	1	3
OH II Scotts	1	3
Ornamec	1	3
Rout	1	3
Ruler	1	3
Weedmaster	1	3

[1]Percent of 35 growers total.

[2]Includes answers marked "Roundup" and "Ruler."

[3]Includes answers marked "Gramoxone" and "Cyclone."

Table 6. Texas Survey - Most Used Fungicides and Bactericides.

Trade Name	No. of Growers	Percent[1]
Fungicide		
Subdue	18	51
Domain[2]	17	49
Banrot	12	34
Daconil[3]	11	31
Funginex[4]	9	26
Zyban	9	26
Chipco 26019	8	23
Dithane[5]	8	23
Kocide	7	20
Terraclor	7	20
Agri-Mycin[6]	7	20
Aliette	5	14
Banner	5	14
Bayleton	5	14
Benlate	5	14
Captan	5	14
Dipel	3	9
Ornalin	3	9
Phyton 27	2	6
Rubigan	2	6
Truban[7]	2	6
Carbamate	1	3
Karathane	1	3
Manex 2	1	3
Methogas	1	3
Strike	1	3
Termil	1	3

[1]Percent of 35 growers total.

[2]Includes answers marked "Domain," "Cleary's 3336," "Fungo-flo," "Topsin-M," and "Thiophanate Methyl."

[3]Includes answers marked "Daconil," "Exotherm Termil," and "Exotherm."

[4]Includes answers marked "Funginex" and "Triforine."

[5]Includes answers marked "Dithane" and "Manzate."

[6]Includes answers marked "Agri-Mycin" and Agri-strep."

[7]Includes answers marked "Truban" and Terrazole."

Table 7. Expenditures for Agricultural Chemicals by Chemical Type.

Pesticide class	National Survey[1]		Texas Survey[2]	
	(million)	percent	(thousand)	percent
Herbicides	$3,644	60	$203	15
Insecticides	1,208	20	473	35
Fungicides	797	13	425	32
Other[3]	434	7	245	18
Total	$6,083	100	$1,346	100

[1]Source: Aspelin, et. al.

[2]28 growers.

[3]"Other" was growth regulators in the Texas Survey.

Table 8. Insects Treated.

Insects	Number of Growers	Percent[1]	Insects	Number of Growers	Percent[1]
aphids	22	65	bees	1	3
whiteflies	21	62	beetles	1	3
fire ants	16	47	borers	1	3
insects (general)	14	41	broad mites	1	3
mealybugs	13	38	caterpillars	1	3
spider mites	13	38	centipedes	1	3
mites	11	32	crickets	1	3
fungus gnats	9	26	cutworms	1	3
ants	8	24	flea beetles	1	3
snails	8	24	flies	1	3
thrips	8	24	lepidoptera	1	3
scale	7	21	millipedes	1	3
slugs	6	18	mosquitoes	1	3
red mites	5	15	pillbugs	1	3
worms	5	15	red ants	1	3
leaf miners	5	15	root mealybugs	1	3
loopers	4	12	rust mites	1	3
fungus gnats larvae	3	9	saw flies	1	3
Japanese beetles	2	6	spittlebugs	1	3
cabbage loopers	2	6	strawberry flea beetles	1	3
grasshoppers	2	6	tomato worms	1	3
shore flies	2	6	two spotted mites	1	3
TCM	1	3	wasps	1	3
armyworms	1	3	yellow jackets	1	3
azalea leaf miners	1	3			

[1]Percent of 34 growers total.

Table 9. Diseases Treated.

Diseases	Number of Growers	Percent[1]	Diseases	Number of Growers	Percent[1]
pythium	16	47	fusarium oxysporum	2	6
phytophthora root rot	11	32	leaf spot	2	6
diseases (general)	9	26	phytophthora aerial blight	2	6
rhizoctonia root rot	9	26	thielaviopsis	2	6
botrytis	7	21	ascochyta	1	3
fungus (general)	6	18	bacterial soft rot	1	3
anthracnose	5	15	bacterial leaf spot	1	3
powdery mildew	5	15	canker	1	3
rhizoctonia	5	15	early blight	1	3
alternaria	4	12	fungus preventative	1	3
black leaf spot	4	12	Gaeumannomyces turf disease	1	3
fungal diseases	4	12	interveinal chlorosis	1	3
entomosporium leaf spot	3	9	leaf blights	1	3
rust	3	9	phalaenopis rot	1	3
xanthomonas blight	3	9	phomopsis blight	1	3
blight	2	6	rhizoctonia aerial blight	1	3
damp-off	2	6	rot	1	3
fire blight	2	6			

[1]Percent of 34 growers total.

Table 10. Weeds Treated.

Weeds	No. of Growers	Percent[1]
weeds	22	65
weeds, grasses	6	18
weeds, broad leaf	5	15
weeds, preemergent	4	12
spurge	2	6
weeds, oxalis	2	6
Johnson grass	1	3
algae	1	3
bittercrest	1	3
crabgrass	1	3
eclipta	1	3
nutgrass	1	3
pigweed	1	3
springtails	1	3
weeds, post	1	3

[1]Percent of 34 growers total.

Table 11. Number of Different Pesticides Used to Control Pests.

Pest	Average number of pesticides/grower	Number of pesticides (range)
Whiteflies	4.9	1 - 18
Aphids	3.1	1 - 14
Spider mites	1.9	1 - 4
Weeds	1.9	1 - 5
Insects (general)	1.7	1 - 4
Fire ants	1.5	1 - 3
Mealybugs	1.5	1 - 2
Phytophthora	1.5	1 - 4
Pythium	1.3	1 - 3

Table 12. Acres treated, total cost, average cost per acre, and effectiveness[1]-weighted average cost per acre for common pests.

Pest	Production Acres Treated	Total Cost	Average Cost per Acre	Effectiveness Weighted Average Cost per Acre
Aphids	480	25,685	54	64
Whiteflies	281	64,859	231	274
Fire Ants	189	3,000	16	19
Insects (general)	220	4,634	21	27
Mealybugs	57	12,930	226	242
Spider Mites	134	19,363	144	61
Pythium	126	9,437	75	106
Phytophthora	102	7,843	77	82
Weeds	320	29,718	93	104

[1]Growers were asked to estimate the percent effectiveness of each pesticide applied. Those estimates were used to calculate the effectiveness weighted average cost per acre.

Table 13. Sales and Cost Information by Category.

Grower Number	Nursery Category	County	Annual Gross Sales	Total Chemical Cost	Chemical Cost- Percent of Annual Gross Sales	Category Average Chemcial Cost- Percent of Annual Gross Sales	Land Acres	Chemical Cost per Acre	Category Average Chemcial Cost per Acre	Production Acres	Chemical Cost per Acre	Category Average Chemcial Cost per Acre
37	Bedding, Flowering, Foliage	Collin	$1,600,000	$14,503	0.91	0.91	4.5	$3,223	$3,223	10.3	$1,408	$1,408
21	Bedding	Cherokee	$20,000,000	$290,851	1.45		43.6	$6,668		130.9	$2,223	
33	Bedding	Jeff Davis	$3,500,000	$49,047	1.40		17.2	$2,849		17.2	$2,849	
3	Bedding	Bexar	$2,000,000	$9,740	0.49		8.0	$1,218		36.0	$271	
30	Bedding	Parker	$1,800,000	$13,506	0.75		8.3	$1,634		20.7	$654	
29	Bedding	Wharton	$700,000	$7,210	1.03		1.1	$6,281		6.9	$1,047	
23	Bedding	Cherokee	$140,000	$618	0.44		0.7	$897		1.4	$449	
22	Bedding	Cherokee	$40,000	$810	2.02	1.32	0.1	$6,228	$1,108	0.3	$3,062	$1,743
6	Container	Bexar	$13,000,000	$464,240	3.57		220.0	$2,110		230.0	$2,018	
9	Container	Harris	$13,000,000	$211,360	1.63		160.0	$1,321		160.0	$1,321	
15A	Container	Cameron	$1,000,000	$10,141	1.01		15.0	$676		17.0	$597	
26	Container	Smith	$700,000	$5,997	0.86		25.0	$240		25.0	$240	
8A	Container	Harris	$125,000	$857	0.69	2.49	3.0	$286	$1,637	3.0	$286	$1,592
7	Field	Denton	$200,000	$6,125	3.06		160.0	$38		160.0	$38	
28	Field	Grimes	$150,000	$2,376	1.58		45.0	$53		45.0	$53	
27	Field	Grimes	$25,000	$249	1.00	2.33	6.0	$42	$41	6.0	$42	$41
2	Flowering	Bexar	$1,200,000	$12,285	1.02		4.5	$2,730		13.5	$910	
31	Flowering	Nueces	$50,000	$642	1.28	1.03	0.5	$1,398	$2,607	0.5	$1,398	$926
20	Foliage	Cameron	$3,700,000	$54,715	1.48		35.0	$1,563		70.0	$782	
11	Foliage	Hidalgo	$500,000	$13,438	2.69		3.7	$3,659		7.3	$1,829	
13	Foliage	Hidalgo	$475,000	$6,161	1.30		5.7	$1,074		17.2	$358	
14	Foliage	Hidalgo	$50,000	$214	0.43	1.58	0.5	$466	$1,661	2.5	$85	$768
	All		$63,955,000	$1,175,087	1.84		767.4	$1,531		980.6	$1,198	

Table 14. Summary of Texas Survey Results by Crop Category (totals, averges, chief responses, etc.).

Item	Bedding Plants	Container Grown	Field Grown	Flowering Plants	Foliage Plants
Questionnaires	10	10	9	5	6
Land Acres - average	8	139	142	3	14
Production to land acres ratio	2.75:1	1.01:1	1:1	3:1	2.07:1
Annual Sales - average (1,000)	4,025	4,133	268	625	1,181
Application Methods	Back pack	Back pack	Back pack	Fogger	Back pack
Non-chemical Methods	Resistant varieties	Hand pruning	Mowing	Several	Mowing
Reasons for Non-chemical Use	Run off & more effective	Non-target species	Non-target species	Less expensive	Less expensive
Presence/Concentration of Pests	Monitor & Visual	Monitor & Visual	Monitor & Visual	Monitor & Visual	Monitor & Visual
Monitoring Frequency					
Insects	Daily & 1/wk	Daily	1/wk	Daily	Daily
Weeds	1/wk	Daily	1/wk & 1/mo	2/wk & 1/mo	Daily
Diseases	Daily & 1/wk	Daily	Daily	Daily	Daily
Treatment Decision Methods					
Insects	Scout & Treat	Scout & Treat	Scout & Treat	Scout & Treat	Scout & Treat
Weeds	Scout & Treat	Prevent. Treatments	Scout & Treat	Scout & Treat	Scout & Treat
Diseases	Scout & Treat	Prevent. Treatments	Scout & Treat	Scout & Treat	Scout & Treat
Information Sources	Suppliers/Dealers	Extension ed/spec	Other growers	Several[2]	Trade journals
No. of Diff. Ag. Chemicals	98	117	22	55	42
No. of Diff. Insecticides	52	57	10	28	21
No. of Diff. Fungicides	31	37	4	20	14
No. of Diff. Herbicides	6	14	8	2	5
Target Pest	Whiteflies	Aphids & fire ants	Weeds	Whiteflies & thrips	Pythium
Ag. Chemical Cost % of Sales	1.32	2.49	2.33	1.03	1.58
Ag. Chemical Cost per Land Acre	1,108	1,637	41	2,607	1,661

Note: See questionnaire questions for complete response options.

AGRICULTURAL CHEMICALS USE QUESTIONNAIRE

Foilage Plant Floral and Nursery Agricultural Crops (Ornamentals)

1. County where farm is located _____

2. Foilage Plant Floral and Nursery Agricultural Crops

   Total land area of crops grown (acres) _____

   Total **production** area of crops grown (acres) _____
   (example: if 3 crops were produced on the same 100 sq ft of land area in 1992, production area would equal 300 sq ft)

   Total production area of crops grown NOT treated with agricultural chemicals _____

   Total production area of crops harvested/sold _____

   Percent retail production sold _____

   Percent wholesale production sold _____

   Total value of crops sold in 1992 _____

3. What five types of application equipment do you use most frequently? (1 meaning most frequent and 2 meaning second most frequent and so on).

   _____ Mist blower
   _____ Back pack sprayer
   _____ Dry application
   _____ Total release aerosol
   _____ Low volume mist sprayer
   _____ Fogger
   _____ Chemigation
   _____ Boom sprayer
   _____ Hand gun
   _____ High volume mist sprayer
   _____ Other (specify)
   _____

4. Describe the top three pests (insect, disease, weed) of foilage plant floral and nursery agricultural crops (in terms of economic loss) you treated during 1992, the primary treatment method you used and the effectiveness of the treatment.

Targeted Pest	Treatment Method (give specific name of chemical or nonchemical method used)	Was Method Effective? (check column)	
		Yes	No

5. *List the top three agricultural chemicals used on your operation in 1992, the purpose for use, and the effectiveness of the* treatment.

Agricultural Chemical	Purpose for Use	Was Method Effective? (check column)	
		Yes	No

6. Please list pest problems (insects, weeds, diseases, etc.) for which adequate control products or methods are impractical or not available.

   _____

   _____

7. Where possible check all nonchemical methods used to control foilage plant floral and nursery pests in 1992.

_____ Culling
_____ Hand pruning
_____ Hand cultivation
_____ Machine cultivation
_____ Grubbing (removing crop)
_____ Resistant varieties
_____ Beneficial insects
_____ Biological insecticides (B.t., Neem, etc.)
_____ Mowing
_____ Mulching
_____ Cover cropping
_____ Barriers/fencing
_____ Wrapping trunks
_____ Nematodes
_____ Other (specify)

_____

_____

_____

8. Please check all reasons for your decision to use non-chemical methods of pest control.

_____ More effective than agricultural chemical.
_____ Less expensive than agricultural chemical.
_____ Concern about agricultural chemical runoff.
_____ Concern about groundwater quality.
_____ Concern about carryover effects.
_____ Concern about health related agricultural chemical problems.
_____ Concern about effects on nontarget species.
_____ Agricultural chemical no longer approved for use.
_____ Done this way in the past, no reason to change.
_____ Other (specify)

_____

_____

9. Please check all techniques you used to measure the presence/concentration of pests in 1992.

_____ Monitoring/scouting
_____ Degree day/heat unit calculations
_____ Monitoring calendars
_____ Traps (blacklight, pheromone, pitfalls, etc.)
_____ Site maps
_____ Visual inspection for disease symptoms
_____ Send specimens to pathology lab

10. How often do you monitor/scout for pests? (check one for each pest type)

	Insects	**Weeds**	**Diseases**
Never	_____	_____	_____
Once a month	_____	_____	_____
Every two weeks	_____	_____	_____
Once a week	_____	_____	_____
Twice a week	_____	_____	_____
Daily	_____	_____	_____

11. Check the methods you use for making your agricultural chemical treatment decisions.

	Insects	Weeds	Diseases
Scout and treat	_____	_____	_____
Calendar date	_____	_____	_____
Preventive treatments	_____	_____	_____
Regular schedule	_____	_____	_____
Plant growth stages	_____	_____	_____
Pest life cycle	_____	_____	_____
Don't treat	_____	_____	_____
Other _____	_____	_____	_____

12. Please check all the sources you use for making decisions on applying pesticides and using nonchemical methods of pest control.

_____ Extension educators/specialists
_____ Extension newsletters
_____ Experiment Station bulletins/personnel
_____ Soil Conservation Service
_____ Trade journals
_____ Suppliers/dealers
_____ Other growers
_____ Nursery association
_____ Other (specify)

_____

_____

OUTSIDE AGRICULTURAL CHEMICAL USE

13. List the agricultural chemicals you used to control pests (insects, diseases, weeds, etc.) of foilage plant floral and nursery agricultural crops in 1992. Give the production area treated, total quantity used for the year, targeted pests, estimated percent effectiveness, and the agricultural chemical cost per pound, gallon, etc., for each agricultural chemical used. Use the agricultural chemical and pest lists provided and enter the corresponding numbers. Write in the agricultural chemicals or pests for those not on the lists. Be sure to include the formulation of all agricultural chemicals.

Trade Name	Formulation	Chemical Name	Total Production Area Treated[1]	Total Quantity Applied[2]	Target Pest(s)[3]	% Effective[4]	Agricultural Chemical Cost[5]

[1]Production area treated in acres or sq. ft. (indicate which).
[2]Total amount of formulation applied in 1992.
[3]All pests treated for (insects, weeds diseases, etc.); use pest list but not limited to that list.
[4]Best guess as to the overall percent control of targeted pests obtained from product applications.
[5]Agricultural chemical cost in dollars per pound, gallon, etc.

GREENHOUSE AGRICULTURAL CHEMICAL USE

14. List the agricultural chemicals you used to control pests (insects, diseases, weeds, etc.) of foilage plant floral and nursery agricultural crops in 1992. Give the production area treated, total quantity used for the year, targeted pests, estimated percent effectiveness, and the agricultural chemical cost per pound, gallon, etc., for each agricultural chemical used. Use the agricultural chemical and pest lists provided and enter the corresponding numbers. Write in the agricultural chemicals or pests for those not on the lists. Be sure to include the formulation of all agricultural chemicals.

Trade Name	Formulation	Chemical Name	Total Production Area Treated[1]	Total Quantity Applied[2]	Target Pest(s)[3]	% Effective[4]	Agricultural Chemical Cost[5]

[1]Production area treated in acres or sq. ft. (indicate which).
[2]Total amount of formulation applied in 1992.
[3]All pests treated for (insects, weeds diseases, etc.); use pest list but not limited to that list.
[4]Best guess as to the overall percent control of targeted pests obtained from product applications.
[5]Agricultural chemical cost in dollars per pound, gallon, etc.

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